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USDA, CDFA Applaud Dominican Research

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Studies conducted at both the NORS-DUC facility in San Rafael and at a commercial nursery in the San Joaquin Valley, which had been under quarantine due to *P. ramorum* infestation for the past 12 months, show that steaming infected soil at temperatures of 50°C and higher for 30 minutes completely eliminated *P. ramorum* from previously infected soil.

"This steam treatment research is a giant step toward controlling the serious nursery plant disease *Phytophthora ramorum* in infested California nurseries," said Robert Leavitt, the California Department of Food and Agriculture's director of Plant Health Inspection. "The CDFA is committed to working with the California nursery industry to maintain California's reputation of producing high quality disease-free nursery plants."

Based on the NORS-DUC results, the USDA has requested that the research team conduct steaming at additional quarantined nurseries in California.

"Our findings support steam as a viable mitigation option in nursery field settings for this pathogen of quarantine significance," said Dr. Sibdas Ghosh, chair of Dominican's Department of Natural Sciences and Mathematics Principal Investigator at NORS-DUC.

The research team presented the findings at the annual meeting American Phytopathological Society (APS) meeting in Rhode Island earlier this month. The research will be presented at the meeting of the International Union of Forest Research Organizations Working Party in Cordoba, Spain, in September.

"Until now, lack of non-chemical methods has hampered the USDA's efforts to mitigate *P. ramorum* in nurseries," said Prakash K. Hebbar, National Program Manager for Emergency and Domestic Programs with the USDA Animal and Plant Health Inspection Service's Plant Protection and Quarantine unit.

Soil steaming has proven successful managing other soil borne disease in the past. The new studies on *P. ramorum* provide nursery owners with an important new tool.

"Low-cost soil steaming, along with biological control currently under field trials, has provided new tools for addressing an important critical control point, presence of *P. ramorum* in soils," Hebbar said.

Sudden oak death has had devastating impact on oak trees and tan oaks in coastal regions in Northern California and parts of Oregon, as well as larch and oak trees in Europe. It is believed that *P. ramorum* can spread from plants into the wild, and in recent years more than 100 nursery plants have been identified as *P. ramorum* host plants.

The rapid emergence of sudden oak death in the mid-1990s spurred emergency regulatory actions designed to control the spread of *P. ramorum* within ornamental nurseries and from infested nursery stock to native wildlands. Today, growers in California face numerous restrictions when it comes to exporting plants. A nursery found to have an infected plant on its property is put under quarantine until the disease is completely removed.

Controlling further spread of *P. ramorum* is a priority for the USDA, which funded NORS-DUC through the 2008 Farm Bill. To date Dominican has received almost $2 million in funding in support of the NORS-DUC facility and research program.

About a year ago the NORS researchers began using steam at the San Rafael research facility on field soil infested with *P. ramorum.* Based on the successful disinfestation following steam treatment, the team began additional tests at a working nursery in November 2011 and again in

May 2012. The privately owned nursery had been under quarantine for *P. ramorum* infestation since July 2011. The nursery has since been released from quarantine as a result of the steam treatments.
At the NORS site, the researchers applied steam to eight areas previously used for *P. ramorum*-infested soils research. Onset temperature probes connected to weatherproof data loggers were used to generate temperature gradient profiles pre-steam, during steam delivery, and in post-steam cooling and to monitor heat transfer across soil depths down to 30 cm. As a control, three field areas were chosen to bury, at variable soil depths, teabag sachets containing soil mixed with viable *P. ramorum*. All pre-steam and post-steam soil samples were assessed for viability dilution plating and leaf bait assays. Post-steam soils were held for 30 days at 4°C, and diagnostic assays were repeated. Whereas pre-steam sachets had an average of 29 cfu/cm3 of *P. ramorum*, all 28 sachets post-steam were negative for *P. ramorum*. Baiting results similarly demonstrated that soil was *P. ramorum* positive pre-steam and negative post-steam.
At the quarantined nursery facility, steaming was performed using methods developed at NORS-DUC, targeting 50°C for 30 minutes down to 30 cm in a sandy loam soil-type. County regulatory officials collected soil samples after the treatment.

Samples were processed at the CDFA's Plant Pest Diagnostics Center. In parallel, independent samples pre- and post-steam were collected across the quarantined area and processed at the NORS-DUC laboratory.

All post-steam samples processed at NORS were *P. ramorum* negative and in agreement with CDFA results that confirmed the regulatory samples were *P. ramorum* negative.
Other *Phytophthora* species previously present in the nursery beds were also eliminated. To restore beneficial soil microorganisms, a soil amendment was applied after post-steam sampling. A variety of chemical options have been used to eliminate the pathogen in the past, including chemicals such as chloropicrin, metham sodium, iodomethane and dazomet. However, chemical treatment is a limited option, as stringent regulations often prohibit or limit fumigation based on a nursery's proximity to urban areas. While steam has been tested in a controlled lab setting in the past, this is the first study of its use in the field.

NORS-DUC is the country's first outdoor research facility focused on studies examining the spread of *P. ramorum* in nursery plants. NORS-DUC was created in collaboration with the California Department of Food and Agriculture, The American Nursery and Landscape Association, California Oak Mortality Task Force, National Plant Board, California Association of Nurseries and Garden Centers, and the USDA. Funding via the U.S. Farm Bill (Section 10201) was secured and is administered by the USDA's Center for Plant Health Science and Technology.
Media coverage of the research discovery appear in the Marin Independent Journal, San Francisco Chronicle, San Jose Mercury News, Oakland Tribune and Contra Costa Times. Also reports on KPIX-TV Channel 5 and KTVU-TV Channel 2.

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